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记甘肃东乡汪集的板齿犀和三趾马化石[1)]

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摘要 汪集的板齿犀化石和周明镇 1958 年所定的"*Sinotherium*" *simplum*，在大小、齿冠高度和构造上都很接近，应归为同种。它们和 *Sinotherium* 的属型种，*S. lagrelii*，有明显的差别，而和 Killgus 于 1923 年 所 定 的 *Parelasmotherium schansiense* 更 为 接 近. 笔 者 认 为 *Parelasmotherium* 属 应 予 恢 复。"*Sinotherium*" *simplum* 应 该 改 称 为 *Parelasmotherium simplum*。汪集新发现的 *Hipparion dongxiangense* 是我国已知三趾马中牙齿尺寸最小的。汪集含上述化石的地点的地质时代可能是晚中新世的早期。

关键词 甘肃东乡，晚中新世，板齿犀，三趾马

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1988 年本文后一作者在甘肃省东乡族自治县中药材店采购到一些牙齿化石，据称是在该县汪集乡采到的。当时对于它们的意义还不甚了解，没有及时报道。近年来，随着该地区哺乳动物化石的不断发现，特别是兰州大学地理系的师生们在临夏盆地作了较大规模的考察和发掘，使我们对这一地区的晚新生代地层层序有了更多的了解。就目前所知，该地区的三趾马动物群的中晚期(即与山西保德大体同时或稍早)的代表性动物已发现很多，但更早期的三趾马动物群的化石至今还没有发现。实际上，不单是在本地区，就是在全国，这一层位的哺乳动物化石也很少发现。汪集的化石只有两种动物：一种是比 *Sinotherium* 更小而原始的板齿犀，另外则是牙齿很小的一类三趾马。它们的地质时代显然比典型的保德期要早些。虽然这个地点的地层还有待于进一步考察，但这些化石的发现本身就很有意义：前者填补了板齿犀演化后期的一个空白；后者是三趾马的一个新种。它们是我国少见的早期三趾马动物群的成员。

V 系古脊椎动物与古人类研究所标本编号，GVD 系甘肃省博物馆的标本编号。文中测量，除特殊注明者外，均以毫米为单位。

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化 石 记 述

副板齿犀属 *Parelasmotherium* Killgus, 1923

Sinotherium Ringström, 1924 (Partim)

Sinotherium Chow, 1958 (Partim)

属型种 山西副板齿犀 *Parelasmotherium schansiense* Killgus, 1923。

属型种的正型标本 可能属于同一个体的右 DP4, M1, M2, 尺、桡骨(缺远端)和左距骨,采集于山西 Kutschwuan(?),秋宾根大学古生物研究所标本。美国自然历史博物馆收藏有模型(AMNH 32503)。

属的特征 一种大型高冠板齿犀。以个体小、上颊齿齿冠较低、不分为冠部与柱部、冠面上次级小褶皱很弱或无,及 M1 冠高等于或小于齿冠最大长等特征而区别于 *Elasmotherium* 和 *Sinotherium*;以高冠型齿(M2 冠高远大于冠长)、颊齿出齿间隔长而区别于板齿犀其它各属。

属的组成 目前仅知两种:*P. schansiense* 和 *P. simplum*。

简饰副板齿犀 *Parelasmotherium simplum* (Chow, 1958)

(Pl. I, 1-5)

正型标本 V 963,右 M3,可能产自山西,现存中国科学院古脊椎动物与古人类研究所。

本文记述标本 GVD 8801:右 M1(Pl. I, 1),中度磨蚀,牙齿前、后及内侧稍破损;左、右 M2 各一(Pl. I, 2—3, 4—5),刚刚开始磨蚀。根据其保存的状况及磨蚀程度判断,上述三个牙齿大概属于同一个体。

产地及层位 甘肃东乡族自治县汪集,晚中新世早期(?)。

种的特征 比 *P. schansiense* 小,上臼齿小刺短小,末端不分岔或分岔很弱,小小刺、后小刺处于萌芽状态,珐琅质层光滑,无次级小褶皱,或发育极弱。

描述 牙齿高冠型,白垩质填充齿谷并覆盖四周。M2 比 M1 萌出的时间晚很多:即 M1 磨蚀至大约一半时,M2 才出齿。齿冠部分向根部逐渐横向变宽,而前后长则在齿冠高的中部最大。后期板齿犀所特有的"柱部"还未分出。

M1 在中度磨蚀时,其冠面形态为不规则长方形:即外长内短,前宽后窄;前附尖相当显著,其后的前附尖褶也很明显,前尖和前附尖差不多等大;原脊的内半部明显后斜,原尖的前、后收缩都很深,原尖纵长,前端较尖而后端宽,其内壁在中点稍前处有明显的垂向沟;反前刺大,其后端微尖;后脊的次尖部分破失,后脊与外脊连接的部分较细,向内逐渐加宽,次尖的前收缩较浅宽(与原尖者相比);小刺比较宽短,末端圆钝,斜向前内伸,其前方有一宽缓的隆起,这可以看作是处于萌芽状态的"小小刺"(cristella, 见 Borissiak, 1914, p. 560);前齿带的外半部位置很高(远离根部):在中度磨蚀的牙齿上,大部分已被磨蚀掉,并和原脊合并,在其内端常常形成一个小的突起(Pl. I, 1);前齿带的内半部急剧下降,在距根约 15—20mm处与原尖前端愈合;后齿带显然较高(远离根部),因为由它和后脊所形

成的三角形后谷已经形成;无外齿带;内齿带可能也不存在,但此处破损,无法作出肯定的判断;后期板齿犀所特有的珐琅质复杂褶皱还几乎没有出现。

表1　M1的测量与比较

Table 1　Measurements and comparison of M1

种 / 测　量	*Parelasmotherium* *simplum*	*Parelasmotherium* *schansiense*	*Sinot. lagrelii* (after Ringström)
Lmax(最大长)	69	80	
Lbas(基部长)	51	66	92*(A); 89*(B)
W at Lmax(最大长处宽)	54	73	
Wmax(最大宽)	67		75*(A); 71*(B)
Hlab(外壁高)	65	70	106(A); 110(B)
Lmax/Hlab	1.06	1.14	0.87(A); 0.81(B)

* 在柱部测量(measured at prism)

左、右 M2 都刚开始磨蚀。虽然它们极可能属于同一个体,但咀嚼面形态并不完全等同:左者原尖收缩明显,反前刺很大,其末端尖,向后和向内弯曲,几乎和小刺连接(Pl. I, 3);小刺几乎伸向正内方,而且末端分叉。右 M2 在差不多同等磨蚀的冠面上原尖收缩很弱,反前刺还没有从原脊中分出,小刺斜向前内方伸,末端不分叉。除此之外,两者基本相同。外壁的构造和 M1 者几乎完全一样(见前),呈微弱波形。从唇侧可明显看出,前附尖褶至齿冠基部逐渐消失,而前尖不但不消失,反而变大,成为外壁最突出的部分(Pl. I, 2);后附尖明显外翘;后附尖在外壁的后缘形成一条细肋。在轻微磨蚀的冠面上,原脊和外脊连接处较细,但原脊本身的磨面已经较宽,比较直地斜向内后方;在中度磨蚀的冠面上(Pl. I, 5),原脊呈弧形弯向后方;自舌侧看,原尖向根部逐渐变宽,其内壁的前后长在接近根部处达 28mm,其内壁上的垂向沟,愈往根部就愈向前移;后脊比前脊细,次尖收缩仅微弱可见;无前刺,但小刺很明显,和 M1 的一样大;其前方的“小小刺”和其后的“后小刺”(postcrista,见 Ringström, 1924, p. 128)微弱可见;前齿带自前面看为一不规则曲线;其最高点位于外 1/3 处,达齿冠高的上 4/5,自此向外,齿带略为降低,形状不很规则,而自此向内,也和 M1 者一样,急剧下降,在齿冠基部与原尖愈合;后齿带较短而近于水平,位于冠高的中部稍稍偏上。这样,当前齿带的外半部开始受到磨蚀时,后齿带还没有磨蚀,而当后齿带已经全部受到磨蚀而形成封闭的后凹时,前齿带的内半部则仍然保留

表2　M2的测量与比较

Table 2　Measurements and comparison of M2

种 / 测　量	*Parelasmotherium* *simplum*	*Parelasmotherium* *schansiense*	*Sinot. lagrelii* (after Ringström)
Lmax(最大长)	76.5; 80	83	
Lbas(基部长)	59; 63		110*
W at Lmax(最大长处之宽)	66.2; 58	60?	
Wmax(最大宽)	76; 74.8		71*
Hlab(外壁高)	120; 118	130	185
Lmax/Hlab	0.64; 0.67	0.64	0.59

* 在柱部测量(measured at prism)

完好;无内、外齿带。我们将右 M2 在齿冠中部(距齿冠顶部约 55mm)处作了切面(Pl. I, 5),可以看出自齿冠向根部的变化趋势:原尖变大,后端变宽,内壁沟的位置前移,前、后收缩变得宽深;前附尖变得粗壮,反前刺变大,小刺变小,位置也相对前移,后谷已封闭,三角形,但细微褶皱仍不明显。

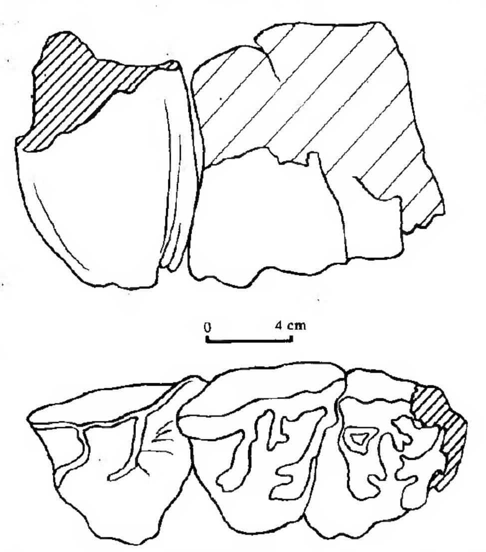


图1 山西副板齿犀的DP4—M2,上:唇侧,下:冠面
(根据美国自然历史博物馆模型AMNH 32503)
Fig.1 DP4–M2 of *Parelasmotherium schansiense*
Upper: Labial view, Lower: Crown view
(based on AMNH 32503)

比较与讨论 从保存情况(石化程度、颜色、围岩等)判断,上述三个牙齿很可能产自同一层位。从大小、形态特征和磨蚀程度来判断,它们也很可能属于同一个体。M1 和 M2 在冠高上差别相当大(见测量)。这正是高冠齿犀类的普遍特征,亦即 M2 出齿晚于 M1 很多。此外,左、右 M2 在形态上也不那么对称一致。考虑到板齿犀牙齿在次级结构和褶皱上个体变异很显著(Borissiak 在 1914 年和 Ringström在 1924 年都已指出这一点),上述差异也可以看作是种内个体变异。

在板齿犀这一类中,个体明显加大而牙齿又真正达到高冠(M2 冠高显著地大于齿冠长或宽)并完全被白垩质填充和覆盖的,只有三个属,即 *Elasmotherium*, *Sinotherium* 和 *Parelasmotherium*。

Elasmotherium 最早是由 Fischer von Waldheim 于 1808 年报道的。但是最早的详细的记述则是 Brandt 于 1878 年提供的。这个属的牙齿齿冠极高,珐琅质强烈褶皱。所有归入这个属的化石和汪集的标本差别都十分明显,这里不再讨论。

Sinotherium 是 Ringström于 1924 年所定,属型种是 *S. lagralii*。它比上一个属稍原始:齿冠稍低,珐琅质褶皱也弱一些。周明镇(1958)为该属建了一个新种 *S. simplum*。Bayshashov(1986)又定了另一个种 *S. zaisanense*。此外还有少量没有鉴定到种的零散材料(Beliajeva, 1971; Bayshashov, 1993)。上述材料,除了 *S. simplum* 外,都和属型种很接近,归入 *Sinotherium* 这个属是没有什么疑问的。*S. simplum* 这个种则显然比它们都原始。我们认为应该归入下一个属。

Parelasmotherium 是 Killgus(1923)创建的。遗憾的是 Killgus 在定名时没有提供图片。Ringström在观察了 Killgus 的材料和照片后,认为它和 *Sinotherium* 的差别只是在大小上,是 *Sinotherium lagrelii* 的同物异名,顶多不过是后者的一个亚种。最近我们有幸在美国自然历史博物馆看到了 Killgus 的材料的模型。从图 1 可以看出,它们在大小和基本形态上和汪集的化石更接近,而和 *Sinotherium* 的属型种有比较明显的差别。我们建议恢复 Killgus 所建立的 *Parelasmotherium* 属。

Parelasmotherium 的个体更小,齿冠更低。这一点 Ringström 虽然已经指出过,但他没有认识到这一差异的显著性。从表 1 和表 2 我们可以看出,在 *Parelasmotherium* 中,在磨

蚀较轻的 M1 上，冠高小于冠长，其冠长／冠高比大于 1；在 *Sinotherium* 同等磨蚀的 M1 中，冠长／冠高比总是小于 1。此外，Ringström在对比他和 Killgus 的标本时使用的是不同高度上的齿冠长度：*Parelasmotherium* 的冠部的长度(最大长)和 *Sinotherium* 的柱部的长度(小于最大长)。如果以 *Parelasmotherium* 的牙齿的近基部的长度和 *Sinotherium lagrelii* 的柱部的长度相比的话，两者在大小上的差别就相当可观了：前一个属的 M1 为 51—66，后一个属的为 89—92；M2 也一样，分别为 59—63和 110(见表 1 和 2)。这一差别实际上是另一个更重要的差异的反映，即其上臼齿是否具备 Borissiak 和 Ringström (1924, p. 137, Textfig. 82—83) 所指出的冠部 (krone，即自外侧面看，齿冠前、后缘呈弧形扩展的部分) 和柱部 (prisma，前、后缘基本互相平行的部分) 的分异。Ringström曾指出，*Elasmotherium* 和 *Sinotherium* 的上臼齿都分为冠部和柱部两部分，而且这两个属在比例上有别：在前一属中，柱部远长于冠部，而在后一属中，两者差不多相等 (Ringström, 1924, p. 140)。在这一点上，Killgus 的和汪集的标本比它们都原始得多：它的柱部还没有分出来，整个牙齿实际上只由冠部一个部分所组成(见 Pl. I, 2 和图 1)。在冠面的构造上，这两个属也有区别。在副板齿犀的颊齿上，次级小褶皱几乎不发育 (Pl. I, 1, 3—5和图 1)，这和 *Sinotherium lagrelii* 的明显不同。Ringström认为这可能是由于 Killgus 的标本磨蚀较轻所致。这一推断不见得正确。因为在副板齿犀的磨蚀得较深的 DP4 上，也没有次级小褶皱。而同样磨蚀的 *Sinotherium lagrelii* 的 DP4 则有很强烈的次级小褶皱 (Ringström, 1924, Pl. XII, 4)。

周明镇所定的"*S.*" *simplum*，在上述各点上和汪集的标本是一致的。它也是没有冠部和柱部的划分(见周明镇，1958，Pl. I, A)，它的珐琅质也是几乎没有什么细微褶皱。周明镇对其冠面的外长的测量达到 105mm。这样一来，它就和 *S. lagrelii* 差不多一样大了。实际上，这是由于它的磨蚀面和牙齿长轴大角度斜交的结果。我们在垂直于牙齿长轴的方向上测量的结果只有 74mm，远小于 *S. lagrelii* 者，而和汪集者差不多大小。此外，周明镇还提到，该种的 M3 后脊的内端有一环状构造，认为这是该种的进步特征。实际上，后期板齿犀牙齿上的次级褶皱变异较大，是普遍的现象。汪集的标本也有类似的情况：其左、右两侧的牙齿的小刺和反前刺的变化就很明显。综上所述，我们认为周明镇所定的"*Sinotherium*" *simplum* 和汪集的标本应为同种，应该归入 Killgus 的 *Parelasmotherium* 属，但它比 *P. schansiense* 个体更小，上臼齿上的小小刺、小刺、后小刺都更弱小，末端基本上不分岔。因此，其种的地位还应保留：*P. simplum*。

东乡三趾马 *Hipparion dongxiangense* sp. nov.

(Pl. I, 6—8)

正型标本　GVD 8802(Pl. I, 6)，右上第一至第三臼齿；此外还有一个单独的右上前臼齿(GVD 8803)。

产地及层位　甘肃东乡族自治县汪集，晚中新世早期(?)。

特征　上颊齿特别小而扁，单个牙齿的冠面长在 20mm 之下，宽在 17mm 之下，齿冠高约在 30—40mm之间，褶皱中等发育，原尖扁长，两端尖，次尖有强烈收缩，次尖沟宽深。

记述　这些牙齿的共同特征是尺寸小，齿冠相对较高，原尖扁长，前后端呈尖角状，褶

皱中等偏弱：原脊褶在三颗牙齿上是一个，在一颗牙齿上是三个；原小尖褶一至二个；前窝褶三个；后窝褶四至五个；次尖褶二至三个；马刺为二。次尖收缩很清楚，M1 的次尖几乎呈孤立状态，次尖沟也更宽深，其外侧有向后伸出的小刺。

测量　单独的前臼齿(GVD 8803)冠面的长 × 宽为 19.3 × 16.3；冠高(自中附尖处测量)为 17.2；其它几个牙齿的测量见表 3。

表3　牙齿测量与比较(长×宽×高)

Table 3　Measurements and comparison of teeth (L×W×H)

种 \ 标本	M1	M2	M3
H. dongxiangense	19.3×16.6×27.4	18.2×14.5×38.5	18.3×14.3×40.0
H. parvum (after Sefve)	18.5×20×?	20×20×?	19.5×17×?

比较与讨论　上述材料虽然很少，但它们确定和我国过去已知的三趾马都不同。首先是在尺寸上：我国目前已知最小的种是 *H. parvum*，它也比汪集的还大(见表 3)。汪集的标本在冠面形态上也很特别：在我国的已知种中，个体较小的种的上牙，长宽都是比较接近的，而汪集者却总是长大于宽。此外，较长的原尖和相对较弱的褶皱在我国的三趾马中也是很独特的。汪集材料中所显示的强烈的次尖收缩和次尖沟的构造，在我国的材料中也是很少见的。

在国外的材料中，在个体上和汪集的标本比较接近的还有欧洲的 *H. matthewi* 和 *H. periafricanum*。但是它们的上牙都是比较接近于方形，它们的原尖都是圆形或短椭圆形，次尖沟都很浅。在没有更多材料的情况下，把汪集的材料归入它们中的任何一个显然都是不恰当的。

应该指出的一点是，汪集的材料中的次尖和次尖沟的构造，在北美中中新世的三趾马(包括 *Hipparion*、*Cormohipparion* 和 *Neohipparion*)中是很常见的特征。它们在后期(指晚中新世)的三趾马，特别是旧大陆的三趾马中很少见到。这应该是残存的近祖性状，也可能反映了汪集这个地点的层位比我国典型的保德三趾马动物群的时代要早些。

结　　论

在汪集发现的两类化石，*Parelasmotherium simplum* 和 *Hipparion dongxiangense*，虽然材料都很少，却是过去在我国很少发现的动物。前者比保德三趾马动物群中的 *Sinotherium lagrelii* 原始，是目前所知向高冠齿方向发展的大型板齿犀的最早的代表。它和三趾马在一起发现表明了其时代不应早于晚中新世。汪集的三趾马是我国到目前为止尺寸最小的一种。它虽然在时代上不能提供更确切的依据，但是它所保留的某些三趾马类的近祖性状倾向于表明，其时代比典型的保德动物群要早，这和板齿犀所反映的时代也是一致的。

致谢　本文作者在查寻 *Parelasmotherium schansiense* 的原始标本的过程中，承蒙美国自然历史博物馆王晓鸣先生协助拍摄及绘制该馆收藏的标本模型，张杰先生为本文摄制照

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NOTES ON *PARELASMOTHERIUM* AND *HIPPARION* FOSSILS FROM WANGJI, DONGXIANG, GANSU

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Key words　Dongxiang, Gansu, Late Miocene, Elasmotheres, *Hipparion*

Summary

The junior author of the present paper happened to have purchased some isolated teeth from a Chinese medicine drug-store of the Dongxiang Nationality Autonomous County, which is situated about 70km southwest of Lanzhou, the capital city of the Gansu Province, in 1988. The fossils were reportedly unearthed from a village called Wangji. The teeth belong to only two forms: an elasmothere, smaller and more primitive than the well known *Sinotherium*, and a *Hipparion* of very small size. It is highly probable that their geologic age is slightly earlier than the typical Baodean Mammal Age. Since the mammalian fossils of the pre-Baodean *Hipparion* fauna are seldom encountered in China, a short report is given below.

Parelasmotherium simplum (Chow 1958)

(Pl. I, 1–5)

Holotype V 963, a right M3, probably from Shanxi, kept in IVPP.

Described specimens GVD 8801: right M1(Pl. I, 1), moderately worn, anterior, posterior and lingual sides slightly damaged; left and right M2, in initial stage of wearing. Judging from their preservation and wearing, the three teeth may be of one individual.

Diagnosis Smaller than *P. schansiense* in size; crista on upper molars small and short, not or very weakly forked at its end, cristella and postcrista in initial stage of development, almost no fine enamel crenulation.

Description The 3 upper cheek teeth are all high–crowned (height by far surpasses length or width in M2). The middle and posterior valleys are completely filled with cement except at the very top of the teeth. Circumferentially the teeth are covered by thin layer of cement. The M1 is about half worn, while the M2 are only in the initial stage of wearing. This would mean that the M2 comes into action long after the M1 has been cut, a phenomenon often occurred in hypsodont animals. The teeth are broadest at their bases, while longest at the middle of the crown height. The so–called prism part (see Ringström, 1924, p. 137, Text–fig. 82–83) has not been differentiated from the crown part.

The M1 is roughly quadrate in form in its crown view, but longer labially than lingually, and broader anteriorly than posteriorly. The parastyle, paracone and the fold between them on the labial wall are clearly shown. Together with the weakly expressed metacone and the outward deflecting metastyle, they form an undulating labial surface. The protoloph, especially its lingual half, slants strongly posteriorly. The protocone has deep anterior and posterior constriction folds. The protocone itself is antero–posteriorly lengthened, with its anterior end rather pointed, but wider posterior part. Its lingual side is centrally furrowed. The antecrochet is large, with pointed end. The anterior hypocone constriction fold is wide and shallow. No crochet is clearly differentiated. The crista is rather stout, with a blunt end. Anterior to it there is a weak bulging part, which can be considered the bud of the "cristella" (Borissiak, 1914, p. 560). The labial part of the anterior cingulum seems to be situated rather high (in the direction away from the root), becomes confluent with the protoloph when the tooth is half worn, often forming a small fold (Pl. I, 1). Its lingual half descends steeply and becomes confluent with the protocone 15–20mm above the root. The V–shaped posterior cingulum should be situated also rather high, because the posterior valley becomes almost completely closed (Pl. I, 1). No cingulum is developed on the labial side. Whether a lingual cingulum is present is uncertain

because of the damage of this part. The secondary plication, so characteristic of the later elasmotheres, is hardly noticeable.

Although the two M2 may belong to one and the same individual and at about the same stage of wear, they differ slightly in morphology. The left one (Pl. I, 3) has a clearly constricted protocone, well developed antecrochet, and a lingually extending crista with a bifid end, whereas the protocone in the right M2 (Pl. I, 4) is very weakly constructed, no antecrochet is visible on the crown surface, and the crista is more anteriorly pointed, with a blunt end. The above described differences may be attributed to individual variation, a phenomenon observed by Ringström in 1924 and Borissiak in 1914 in later elasmotheres. Seen from the labial side (Pl. I, 2), the parastyle remains equally strong from top to bottom, while the parastyle fold becomes narrower, but the paracone wider toward the root. The metastyle becomes stronger and rib-like toward the base. The labial wall is covered by vertical wrinkles. Differing from the M1, the M2 is more lengthened antero-posteriorly. At least on the cross section of the right M2 (Pl. I, 5) the crista is more anteriorly positioned, leaving a room for the emerging "postcrista" (see Ringström in 1924, p. 128), if there is any. The protocone is very large, and triangular in form, with its posterior part much more broadened.

For the measurements see Table 1 and 2.

Discussion Among the generally high-crowned elasmotheres there are only three genera with their teeth reaching true hypsodonty (height by far surpasses length or width in M2): *Elasmotherium*, *Sinotherium* and *Parelasmotherium*.

The specimens from Wangji can readily be distinguished from *Elasmotherium*. The latter is characterized by extremely high-crowned teeth with particularly complex enamel plications.

Sinotherium was established by Ringström in 1924. The teeth of the genotype, *S. lagrelii*, and *S. zaisanense* Bayshashov, 1993, are slightly less high-crowned and more primitive in character than those of *Elasmotherium*, but larger, more high-crowned and more advanced in character than the specimens from Wangji. However, the type specimen, a M3, of *S. simplum* Chow, 1958, is very close to the specimens from Wangji. Together with the Wangji material, it should belong to the next genus as explained below.

Parelasmotherium was erected by Killgus in a paper published in 1923. The material includes a series of teeth, right DP4, M1, M2, radius, ulna (without distal epiphyses) and left astragalus, probably of one individual, collected from Kutschwuan (?), Shanxi, China. Killgus' description of the teeth, accompanied by measurements, was sufficiently detailed for distinguishing them from the other known elasmotheres. Unfortunately, the material was not illustrated. While creating *Sinotherium*, Ringström

not only knew Killgus' work, but also studied Killgus' material. He considered the two samples inseparable at species level and abandoned Killgus' generic name. The senior author of the present paper has the possibility to locate the casts of the teeth described by Killgus in the AMNH Collection. An observation of the material has not only verified what described by Killgus, but also revealed the clear distinction between the upper cheek teeth of the genus *Sinotherium* on the one hand, and those from Wangji and Killgus' samples on the other hand.

Parelasmotherium is smaller in size than *Sinotherium lagrelii*, a point also admitted by Ringström. The crown height of the first genus is comparatively small. This is particularly well demonstrated in slightly worn M1. While in *Parelasmotherium* its height is smaller than its maximum length, therefore, L / H ratio is more than 1, in *Sinotherium lagrelii* height surpasses its length, and L / H ratio is less than 1 (see Tab. 1). Furthermore, the fine enamel crenulation is almost absent in the first genus, while in the other it is well developed. However, the main distinction between the two genera lies in the form of the crown when viewed from the labial side. As is pointed out by both Borissiak and Ringström, the upper cheek teeth in both *Elasmotherium* and *Sinotherium* can be divided into two parts: prism and crown, although their proportions are different: roughly 2:1 in *Elasmotherium*, and 1:1 in *Sinotherium*. No such subdivision can be found in Killgus' sample and in the material from Wangji.

The M3 of *S. simplum* described by Chow in 1958 is inseparable from the later sample in this respect (see Chow, 1958, Pl. I, A). The length of the crown given by Chow was 105mm. But it was apparently measured on the worn surface, which formed an acute angle with the shaft of the tooth. A new measurement of the length made perpendicular to the shaft of the tooth is only 74mm, thus fully comparable with those from Wangji and Killgus' samples. Based on the above argumentation, we feel it appropriate to revive Killgus' *Parelasmotherium* as a valid genus. Killgus' species name, *schansiense*, though clumsily spelt, is to be adopted as the genotype. The above described material from Wangji are included in the species erected by Chow in 1958, namely: *Parelasmotherium simplum*.

***Hipparion dongxiangense* sp. nov**

(Pl. I, 6–8)

Holotype GVD 8802, right M1–M3, and GVD 8803, a single right upper premolar.

Diagnosis Size very small: length of single upper tooth less than 20mm, width less than 17mm, height of crown about 30–40mm; plication medium strong, protocone oval, pointed at ends, hypocone strongly constricted, hypoconal groove deep and wide.

Description and discussion The pli protoloph is single on three teeth, 3 on one

tooth; pli protoconule 1 or 2; pli prefossette 3, pli postfossette 4 to 5; pli hypostyle 2 or 3; pli caballine 2. The hypocone on M1 is almost separated from the hypoloph. Its hypoconal groove is deep and wide, with clear doubled spur pointed posteriorly. For measurements see Table 3.

Although the material is too poor to draw any conclusion as to the true affinity of the present hipparionine species, it is safe to say that these small teeth are readily distinguishable from all the hipparionine species so far known from China and adjacent areas. It is even smaller than the smallest species in China, *Hipparion parvum*. The upper cheek teeth of the small sized species are generally quadrate in crown form, but the teeth from Wangji are longer than wide. *H. matthewi* and *H. periafricanum* are also small in size, but their upper cheek teeth are always quadrate in crown form, with rather rounded protocone. The structure in hypoconal part of the teeth from Wangji is rather unique for a Chinese hipparionine species. Similar structure is often observed in North American hipparionines of Middle Miocene, for example, in *Cormohipparion goorisi* etc. (see MacFadden, 1984). This may allude to the early geologic age of the Wangji *Hipparion* in comparison with the other Chinese species commonly found from the Baodean Mammal Age. This is in accordance with its co-occurrence with *Parelasmotherium*, which is also more primitive than *Sinotherium*, a form characteristic of the Baodean Mammal Age.

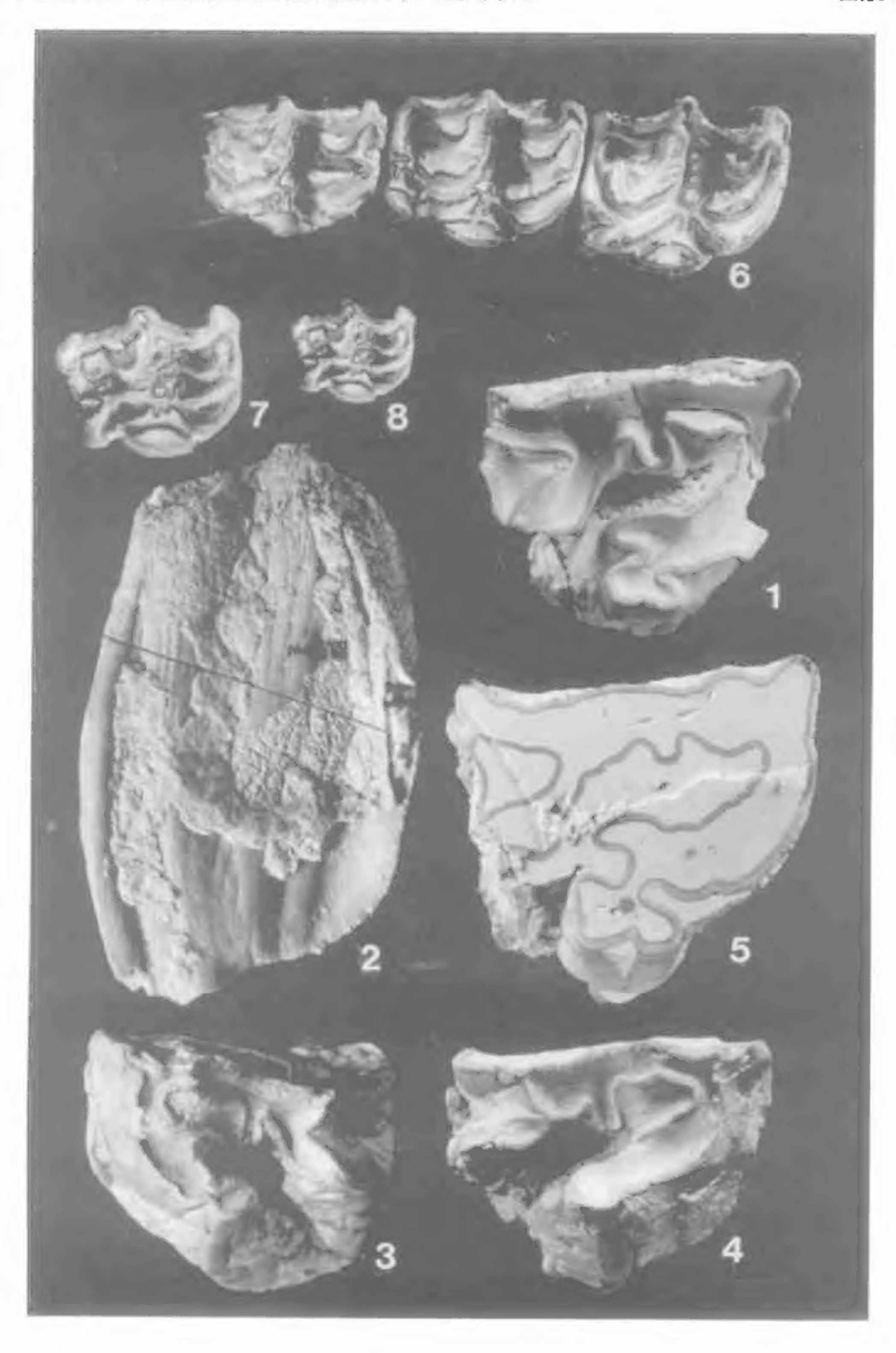
图版 I 说明 (Explanations of plate I)

简饰副板齿犀 (*Parelasmotherium simplum*)，GVD 8801，×2 / 3

1. 右 (right) M1，冠面 (crown view)
2. 左 (left) M2，唇面 (labial view)
3. 左 (left) M2，冠面 (crown view)
4. 右 (right) M2，冠面 (crown view)
5. 齿冠中部横断面 (Cross section at middle crown height)

东乡三趾马 (*Hipparion dongxiangense*)

6. GVD 8802，右 (right) M1—M3，冠面 (Crown view)，×2
7. GVD 8803，右 (right) P?，冠面 (Crown view)，×2
8. 同上 (As above)，×1


6
7
8
1
2
5
3
4